

# Feed Grains

## Background for 1995 Farm Legislation

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### Introduction

Feed grains are comprised of corn, sorghum, barley, and oats. While these field crops are grown in most States, production of each of these crops is concentrated in various regions of the United States—corn is primarily grown in the Midwest and Central Plains States, sorghum in the Central and Southern Plains States, and barley and oats in the Northern Plains and Northwest. Over the last 5 years (1990-94), feed grain planted area averaged 104 million acres annually, accounting for 32 percent of total principal crop area, which averaged 324 million acres.

Feed grains rank highest among all crops in terms of total crop value, accounting for more than 25 percent of total value of crop production in the United States. Over the last 5 years, the value of feed grain production averaged \$21.4 billion annually. The value of all crops, including field and miscellaneous crops plus fruit and nut crops, averaged \$85.4 billion during this period.

Corn is the major U.S. feed grain, accounting for slightly more than 85 percent of total production. Sorghum is the second largest feed grain crop at 7 percent, with barley and oats representing the remaining 4 and 2 percent, respectively. The share of feed grain production represented by sorghum and oats has been declining over time. In the mid-1970's, sorghum and oat production averaged 10 and 5 percent of total feed grain production, respectively. Barley production, as a share of total production, has remained relatively stable while corn's share of production has increased from 81 percent in the mid-1970's to its current share of 87.

Feed grains are versatile commodities. Although they are major inputs for livestock production, feed grains are also processed and used for human food and beverage consumption, and industrial purposes. Corn is processed by wet millers into (1) high-fructose corn syrup (HFCS), (2) glucose and dextrose, (3) starch, (4) alcohol, and (5) cereal and other food products. Dry millers process corn into cereal and other food

products and alcohol. Both milling processes produce high-protein grain byproducts, which are utilized by the livestock feed industry.

Feed grains are the major ingredient in livestock feeding enterprises, and feed and residual use has accounted for about 60 percent of the total annual use since 1975. Food, seed, and industrial (FSI) uses have increased over time from less than 10 percent in the mid-1970's to nearly 20 percent in recent years. In contrast, exports of feed grains declined from nearly 30 percent of total use in the mid-1970's to just under 20 percent over the last 3 years (1991/92-1993/94).

The United States is the largest producer of feed grains in the world, averaging 239 million tons annually during the last 5 years.<sup>1</sup> During this period, the U.S. share of world production averaged 29 percent. This is more than twice the average production of China, the second largest producer, which averaged 114 million tons annually.

Corn is the major component of global coarse grain trade, generally accounting for about two-thirds of the volume over the last decade. Barley follows with nearly 20 percent, sorghum at slightly less than 10 percent, and oats and rye make up the balance with about 5 percent.

The United States is the leading exporter of feed grains in the world, averaging 50 million tons annually during the last 5 years and representing 56 percent of world coarse grain trade. Exports of feed grains from China, the second largest exporter, averaged just under 9 million tons annually. The United States dominates world trade in both corn and sorghum with average market shares of 70 and 80 percent during the last 5 years.

In recent years, the United States has become a significant importer of barley and oats. Since 1983, the United States has been the world's largest importer of oats. These imports have increased fairly steadily over

<sup>1</sup>"Tons" refers to metric tons hereafter unless otherwise specified.

the last decade, reaching a record in 1993/94. Barley imports also reached a record in 1993/94 at 71 million bushels, exceeding exports for the first time since 1969. Exports of U.S. barley were 66 million bushels in 1993/94 compared with the previous 5-year average of nearly 85 million bushels.

With the large volume of exports, feed grains contribute significantly to the U.S. balance of trade. On a fiscal year basis, feed grain and feed grain product exports were valued at \$6.5 billion annually during the last 5 years, accounting for 16 percent of the value of agricultural exports (\$41.1 billion).

Farm legislation has played a major role in the farm sector since the 1930's. Government payments to feed grain producers increased from less than \$250 million in 1975 and 1976 to \$9.5 billion in 1987, and declined significantly to an average of \$3.8 billion during 1991-93. More market-oriented farm programs were implemented with the 1985 farm legislation and were continued with the 1990 legislation, the current law.

## Characteristics of the Feed Grain Industry

Feed grains comprise the single largest category of crops grown in the United States. During the last decade, area planted to feed grains averaged 108 million acres, representing nearly a third of the total area planted to principal crops (table 1). Area planted to corn, the leading feed grain, averaged nearly 75 million acres or 23 percent of total principal crops and 70 percent of all feed grains (fig. 1). Area planted to sorghum averaged 12 million acres, representing about 4 percent of principal crops. Barley and oats plantings averaged 10 and 11 million acres, respectively. The area planted to sorghum, barley, and oats trended downward during the last 10 years, declining from 45 million acres in 1985 to 24 million in 1994.

Feed grains are also the leading crop based on farm values. The value of feed grains ranged from \$15 billion in 1986 to over \$25 billion in 1982 (table 2). During the last 5 years, the value of feed grain produc-

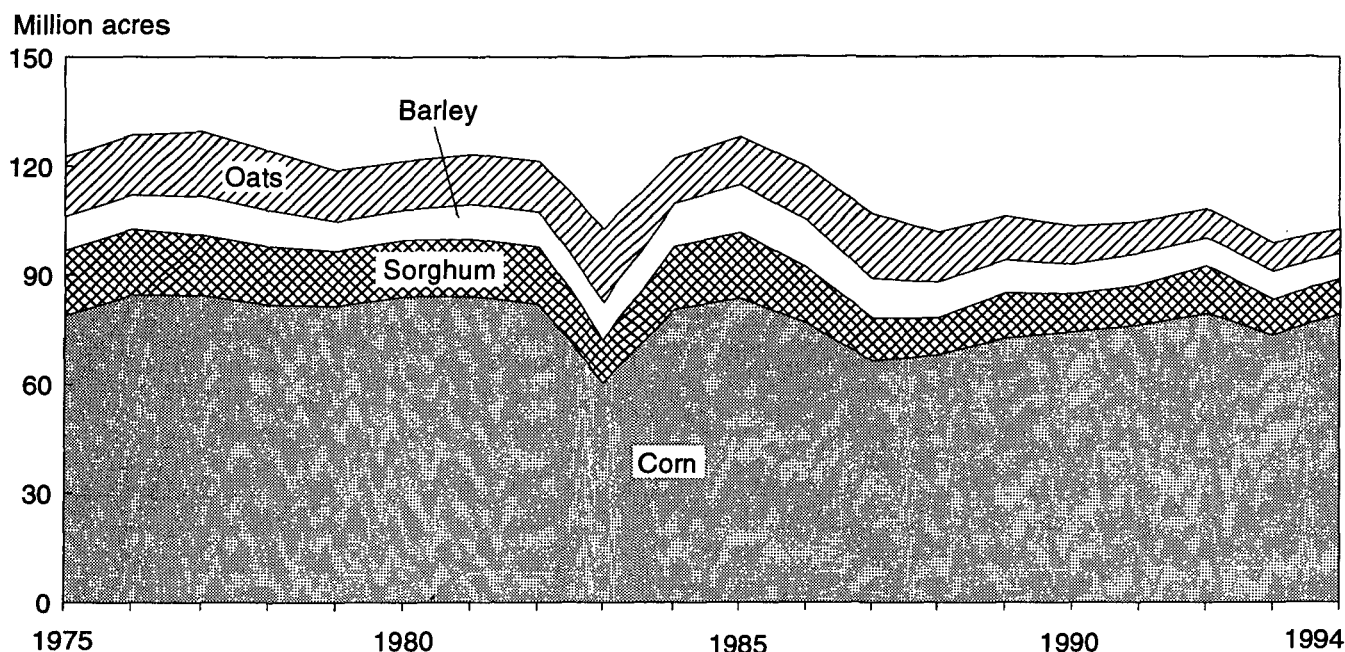
**Table 1—Comparison of feed grains to principal crops: Planted area**

Year	Principal crops	Feed grains	Corn	Sorghum	Barley	Oats
<i>Thousand acres</i>						
1975	336,091	122,606	78,719	18,080	9,373	16,434
1976	344,873	128,652	84,588	18,143	9,301	16,620
1977	336,438	129,474	84,328	16,636	10,778	17,732
1978	345,803	124,268	81,675	16,197	9,989	16,407
1979	355,677	118,747	81,394	15,277	8,116	13,960
1980	363,167	121,383	84,043	15,639	8,320	13,381
1981	358,708	123,277	84,097	15,930	9,618	13,632
1982	345,020	121,385	81,857	16,028	9,549	13,951
1983	342,146	102,787	60,207	11,880	10,411	20,289
1984	358,257	122,119	80,517	17,254	11,934	12,414
1985	353,042	128,057	83,398	18,285	13,139	13,235
1986	338,220	119,614	76,580	15,339	13,024	14,671
1987	315,263	106,792	66,200	11,756	10,929	17,907
1988	318,032	101,798	67,717	10,343	9,831	13,907
1989	331,152	106,174	72,322	12,642	9,125	12,085
1990	326,337	103,345	74,166	10,535	8,221	10,423
1991	325,362	104,615	75,957	11,064	8,941	8,653
1992	326,453	108,193	79,311	13,177	7,762	7,943
1993	319,553	98,840	73,235	9,882	7,786	7,937
1994	324,256	102,733	79,158	9,772	7,159	6,644
1985-94 average	327,767	108,016	74,804	12,280	9,592	11,341
Percent of total		33.0	22.8	3.8	2.9	3.5

Principal crops include corn, sorghum, oats, barley, winter wheat, durum wheat, other spring wheat, rice, rye, soybeans, peanuts, sunflowers, cotton, all hay, dry edible beans, potatoes, tobacco, sugar beets, and sugar cane.

Source: *Crop Production*, various issues, NASS, USDA.

Figure 1  
**Feed Grains: Planted Acreage**



tion averaged \$21 billion, or 25 percent of all principal crops. The value of corn averaged \$19 billion annually over the last 5 years, representing 22 percent of the value of all crops. The value of the corn crop as a percent of total feed grains has increased over the last 20 years, from an average of 83 percent during 1975-80 to 88 percent during the last 5 years. The farm value of sorghum since 1975 peaked at \$2.2 billion in 1985. Since 1985, the farm value of sorghum has declined nearly 50 percent to \$1.3 billion in 1994. The value of oats has declined nearly 70 percent from \$954 million in 1981 to \$293 million in 1994. The value of barley production has remained relatively stable, at nearly \$1 billion since 1975.

## Structure of the Feed Grain Industry

### Trends in Production

Total U.S. feed grain production has trended upward since the 1930's. Production of corn has more than doubled since 1965, reaching a record 10 billion bushels in 1994 (app. table 1). Much of the increase was due to yield improvements, especially for corn. Year-to-year fluctuations in production occur, however, because of such factors as the weather and feed grain programs. Drought in 1988, for example, reduced production by more than 30 percent from the previous year. In 1993, excess rainfall caused late plantings, abandoned acreage, and reduced yields, which, together

with a 10-percent set-aside, reduced corn production by a third from 1992 levels.

Corn production in the United States increased from 5.8 billion bushels in 1975 to 9.5 billion in 1992, and is estimated to have reached a record 10.1 billion bushels in 1994 (fig. 2). Yields during this time increased from 86 bushels per acre to nearly 139 bushels in 1994. The long-term increase in yields is about 1.5 to 2.0 bushels per acre annually. Corn yields have varied significantly, due mainly to weather. Over the last decade, both drought and floods have reduced yields by as much as 30 percent from the previous year. In 1983, corn yields averaged 81 bushels per acre, 28 percent below the 1982 average yield of 113 bushels, which was then record high (fig. 3). Similarly in 1988, drought reduced average yields to 85 bushels per acre, down 29 percent from the then record 1987 yield of 120 bushels. In 1993, severe flooding in the Midwest and drought in the Southeast reduced average corn yields to 101 bushels per acre, down 23 percent from the record 1992 yield.

Increases in corn yields over time have been attributed mainly to improvements in technology and production practices. Technological innovations and improvements have occurred with hybrid seeds, fertilizers, pesticides, and machinery. Soil and water conservation practices, including reduced tillage, irri-

gation, crop rotations, and pest management systems, are examples of improved production practices. Irrigated corn acres accounted for 14 percent of all corn acres harvested in 1992, up slightly from 12 percent in 1982. Improved management of farm resources has also been cited as a source of increased productivity. Application rates of fertilizers have declined since 1984, yet yields have continued to rise.

While corn is grown in most States, most production occurs in a region bounded by Ohio to the east, Nebraska to the west, Missouri to the south, and Minnesota to the north. The top 10 States in this region produced 8.5 billion bushels in 1994, 84 percent of the U.S. corn crop (table 3). Iowa and Illinois, the two top producing States, typically account for slightly more than a third of the crop.

Production of sorghum, barley, and oats all trended down over the last decade, primarily reflecting reductions in acreage (fig. 4). Acres planted to feed grains are all lower than in the mid-1980's, when acreage of all the feed grains except oats spiked upward. The declines in acreage were especially pronounced for oats, barley, and sorghum. In the case of oats, acres planted dropped by about 50 percent between 1985 and 1994, continuing the long-term downward trend that started in the mid-1950's. Acres planted to sorghum and barley each declined by more than 45 percent during this period.

During 1990-94, the share of malting barley acreage planted in 9 major producing States (including Wyoming) remained stable at around 62 percent, while feed barley share remained at 38 percent (table 4). Acreage planted to malting barley varieties in the major pro-

**Table 2—Crop values: 1975-94**

Year	Principal crops	Feed grains	Corn	Sorghum	Barley	Oats
<i>Million dollars</i>						
1975	56,778	18,425	14,818	1,777	906	924
1976	55,666	16,642	13,524	1,431	852	835
1977	57,256	16,102	13,107	1,412	760	823
1978	64,866	19,305	16,281	1,464	871	689
1979	77,272	23,339	19,877	1,876	872	714
1980	81,641	24,081	20,554	1,697	1,017	813
1981	83,247	24,387	20,200	2,079	1,154	954
1982	81,094	25,568	21,641	1,928	1,115	884
1983	70,125	17,001	13,553	1,384	1,270	794
1984	79,598	24,350	20,144	2,050	1,357	799
1985	74,553	23,534	19,519	2,243	1,130	642
1986	60,521	15,288	12,507	1,323	989	469
1987	98,857	16,860	14,108	1,179	967	606
1988	72,746	15,306	12,661	1,337	775	533
1989	80,635	20,674	17,869	1,288	968	549
1990	80,782	20,743	18,192	1,221	912	418
1991	79,582	20,500	17,864	1,331	996	309
1992	87,450	22,736	19,723	1,667	946	400
1993	84,129	18,371	16,032	1,235	813	291
1994	94,953	24,561	22,158	1,331	779	293
1975-94 average	76,088	20,389	17,217	1,563	972	637
Percent of total		26.8	22.6	2.1	1.2	0.8
1990-94	85,379	21,382	18,794	1,357	889	342
Percent of total		25.0	22.0	1.6	1.0	0.4

Value of principal crops includes field and miscellaneous crops, fruits and nuts, and commercial vegetables.

Source: *Crop Values*, various issues, NASS, USDA.

Figure 2  
**U.S. Corn Production**

Billion bushels

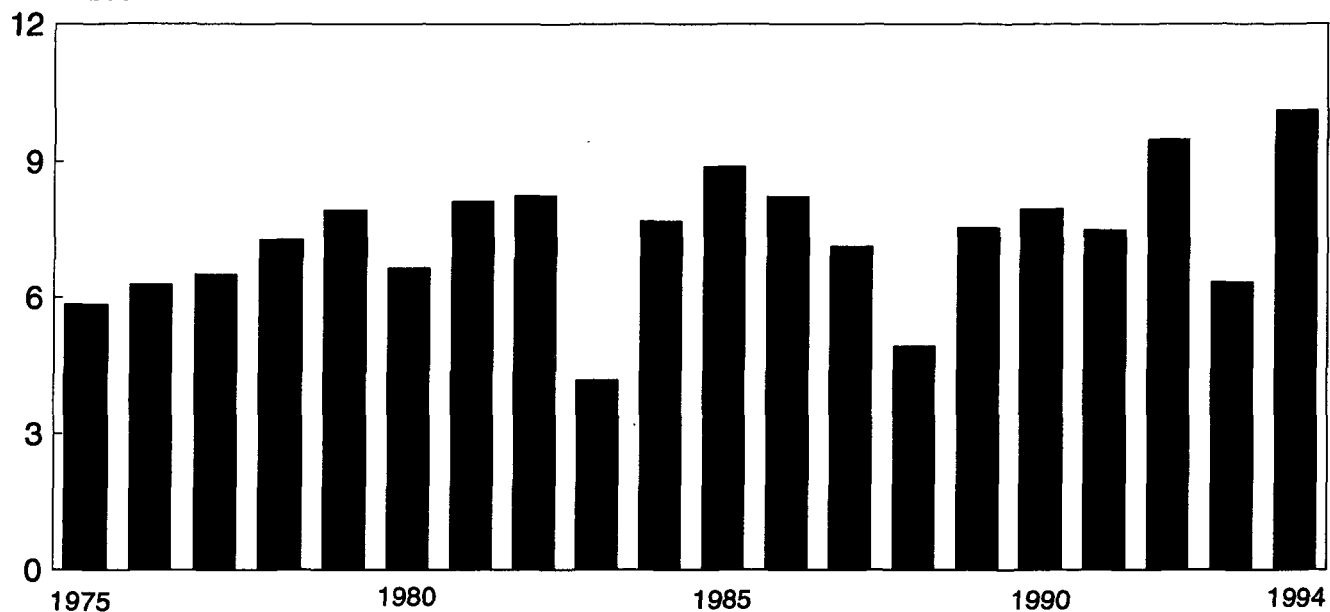
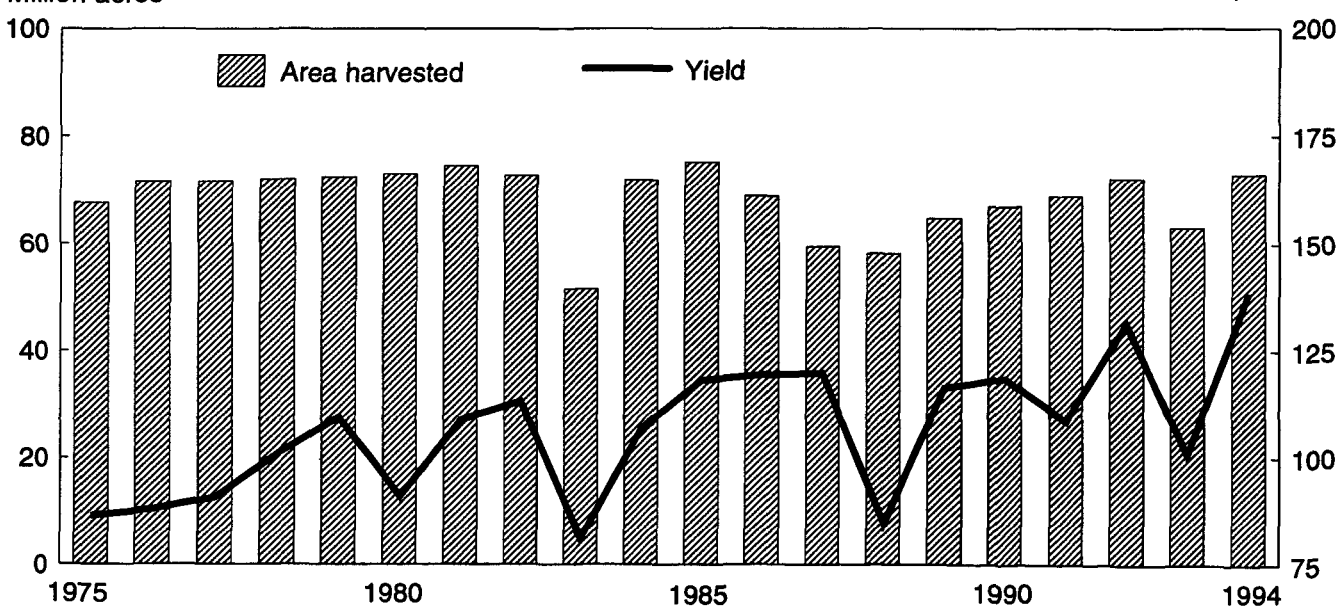


Figure 3  
**Corn: Area Harvested and Average Yield**

Million acres

Bushels per acre



ducing States stood at about 4 million acres in 1994, down from 6.4 million acres in 1985. This does not mean that all the crops on these acres were of "malting" quality or, even if of malting quality, that they were used for malting. Excess malting barley is used for feeding.

A policy factor that would have a significant effect on future feed grain production is the long-term Conser-

vation Reserve Program (CRP). In 1994/95, about 11 million feed grain acres were enrolled in the CRP, the equivalent of 11 percent of all acres planted to feed grains. Unless Congress renews the CRP, acres planted to feed grains in the future are projected to increase because the CRP contracts will begin to expire in late 1995. According to a USDA-funded survey conducted by the Soil and Water Conservation Society,

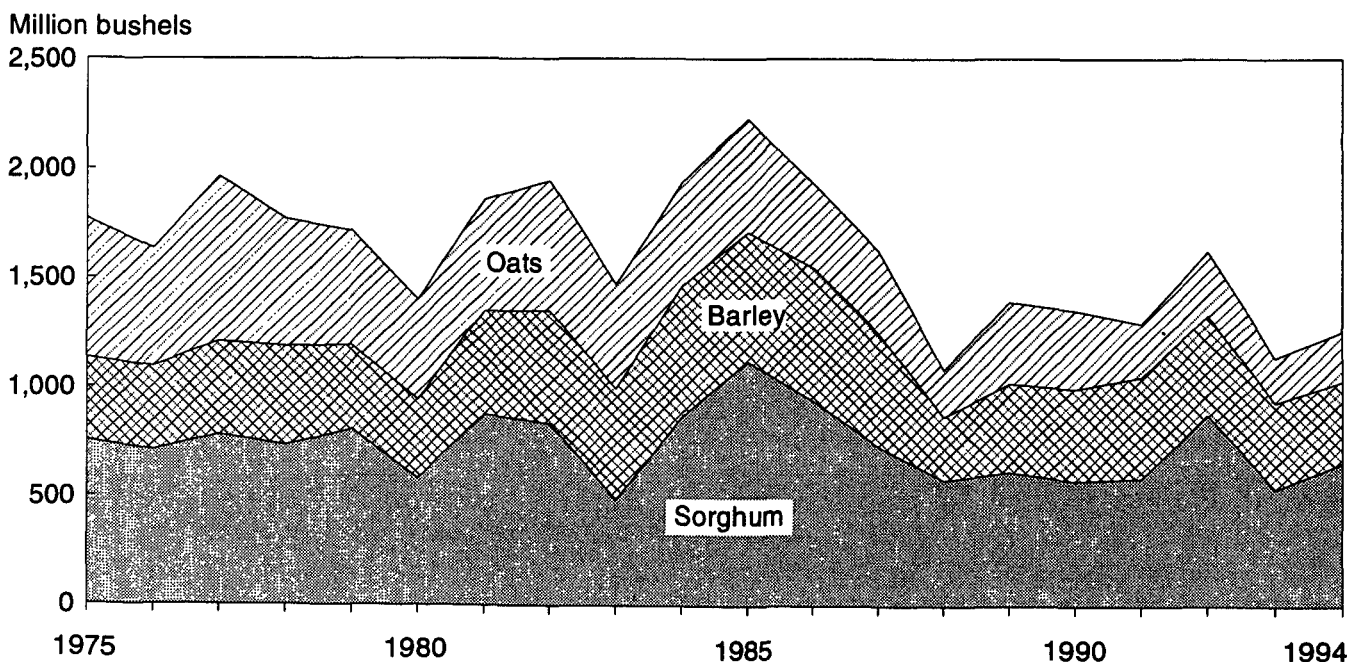
**Table 3—Top corn-producing States**

1994 rank	State	1975	1980	1985	1990	1994 <sup>1</sup>
<i>Million bushels</i>						
1	Iowa	1,118	1,463	1,707	1,562	1,930
2	Illinois	1,254	1,064	1,535	1,321	1,786
3	Nebraska	503	604	954	934	1,154
4	Minnesota	407	610	725	763	916
5	Indiana	552	603	756	703	858
6	Ohio	311	441	512	417	487
7	Wisconsin	198	348	358	354	437
8	S. Dakota	83	122	252	234	367
9	Kansas	141	111	152	189	305
10	Missouri	170	110	273	238	274
10-State total		4,737	5,475	7,224	6,715	8,514
Percent of U.S.		81.1	82.5	81.4	84.6	84.3
U.S. total		5,841	6,639	8,875	7,934	10,103

<sup>1</sup> Estimate as of January 12, 1995.

Source: *Field Crops: Estimates by States*, various issues, NASS, USDA.

**Figure 4**  
**Barley, Oats, and Sorghum Production**



**Table 4—Acreage of feed and malting barley planted in major producing States**

State	1980	1985	1990	1991	1992	1993	1994
<i>1,000 acres</i>							
<b>North Dakota:</b>							
Total	1,850	3,500	2,600	2,900	2,700	3,000	2,600
Feed	209	560	594	652	609	685	510
Malting	1,641	2,940	2,006	2,248	2,091	2,315	2,090
<b>Montana:</b>							
Total	1,180	2,350	1,600	1,800	1,350	1,300	1,300
Feed	615	1,182	931	1,111	967	878	826
Malting	565	1,168	669	689	383	422	474
<b>Idaho:</b>							
Total	900	1,280	790	800	740	770	740
Feed	513	870	346	354	329	353	381
Malting	387	410	444	446	411	417	359
<b>Minnesota:</b>							
Total	900	1,200	850	900	700	725	650
Feed	45	60	106	41	35	10	17
Malting	855	1,140	744	859	665	715	633
<b>South Dakota:</b>							
Total	535	760	630	500	400	400	380
Feed	176	245	172	182	168	179	180
Malting	359	515	458	318	232	221	200
<b>Washington:</b>							
Total	440	1,200	350	580	450	350	310
Feed	381	1,125	299	497	392	310	277
Malting	59	85	51	83	58	40	33
<b>Oregon:</b>							
Total	170	360	135	190	170	165	140
Feed	124	328	122	173	152	151	130
Malting	46	32	13	17	18	14	10
<b>Colorado:</b>							
Total	265	360	155	140	130	100	90
Feed	144	293	51	33	31	25	24
Malting	121	67	104	107	99	75	66

Note: Malting varieties planted include all those recommended by the American Malting Barley Association for malting and brewing and other nonrecommended varieties used for malting and brewing. Not all malting barley varieties harvested meet malting quality specifications.

Source: American Malting Barley Association and U.S. Department of Agriculture, National Agricultural Statistics Service.

as much as 60 percent of cropland currently enrolled in the CRP could return to production. However, in December 1994, the Secretary of Agriculture announced several new provisions modifying and extending CRP contracts. These include options for early termination of contracts and targeting more environmentally sensitive acres for new enrollments. These changes suggest that less than 60 percent of enrolled acreage will return to production and total CRP acreage will likely stay closer to current levels.

### **Number and Size of Farms**

The number of farms in the United States has continued its long-term declining trend, down from 2.3 million in 1974, to 2.2 million in 1982, and to 1.9 million in 1992. During 1974-92, average farm size expanded from 440 acres to 491 acres. Changes in the number of feed grain farms and average farm size followed a similar pattern, but at a more rapid rate. For example, the number of farms growing corn declined from

883,300 in 1974 to 503,900 in 1992, while the average corn acreage per farm expanded from 69.8 acres to 137.6 acres. This general trend for farms growing corn also applied to farms growing sorghum, barley, and oats. Although the number of farms growing barley increased temporarily between 1982 and 1987 due to brighter net returns in the late 1980's, it declined again in 1992 according to the newly released 1992 Census of Agriculture data, reflecting the enrollment of more barley acreage in the CRP.

Feed grain production has continued to be concentrated on larger farms. About 11 percent of farms growing corn averaged more than 1,000 acres in 1992, up from 8 percent in 1987 (table 5). In 1992, farms with 500 acres of farmland or more accounted for 29 percent of farms growing corn but nearly 70 percent of corn production. Farms with less than 100 acres of farmland accounted for 19 percent of farms growing corn, but produced only 2 percent of the corn. The farms' sales receipts from all production also expanded—3 percent of the farms had more than \$500,000 worth of sales in 1992, compared with 1.6 percent in 1987 (table 6).

Most farms harvesting corn were cash grain farms, while other farms were also involved in livestock operations. More of the large farms tended to be cash grain farms. Corn was the primary crop grown by all farms growing corn, while soybeans and hay crops were also common, along with livestock production. The remaining cropland was used for growing wheat, oats, sorghum, and barley. The enterprise mix also varied by region. For example, farms growing corn in the eastern Corn Belt tended to be cash grain farms while those in the western Corn Belt were corn/livestock farms.<sup>2</sup> The planting flexibility provision in 1990 farm legislation permits producers to plant the crop of their own choice on up to 25 percent of their base acreage—a 15-percent "normal flex acres" (NFA) and an additional 10-percent "optional flex acres" (OFA). No payments are made on the NFA, but producers can plant program or other crops. Planting to the other crops allowed by the Secretary of Agriculture does not affect their farm program base acreage and thereby encourages producers to base their planting decisions more on market forces and less on Government farm programs (see box, "Crop Acreage Base," on page 10).

<sup>2</sup>Eastern Corn Belt States include Illinois, Indiana, Ohio, and Wisconsin, while western Corn Belt States include Iowa, Minnesota, Nebraska, Kansas, Missouri, and South Dakota.

### Program Participation in the Early 1990's

An important aspect of the feed grain programs is to balance expected supply and use through the implementation of annual acreage reduction programs (ARP). The ARP often requires participants to set aside a certain percentage of their base acreage for conserving use in exchange for price and income supports. Program participation depends on relative net returns between participation and nonparticipation: a higher ratio of net returns from program participation relative to nonparticipation provides economic incentives for participation. A high rate of program participation, given the set-aside requirement, would in turn lead to larger set-aside acres and reduce acre-

**Table 5—Number of farms in the United States by size of farm, 1992 and 1987**

Size of farm	Farms		Percentage	
	1992	1987	1992	1987
<i>Acres</i>	<i>- - - - Number - - - -</i>		<i>- - Percent - -</i>	
<b>Corn</b>				
1-99	95,016	131,880	18.9	21.0
100-259	148,939	199,907	29.6	31.9
260-499	112,521	142,552	22.3	22.7
500-999	90,403	100,706	17.9	16.0
1,000+	57,056	52,557	11.3	8.4
Total	503,935	627,602	100.0	100.0
<b>Sorghum</b>				
1-99	5,276	7,227	7.4	8.1
100-259	11,187	16,014	15.8	17.9
260-499	13,052	17,864	18.4	19.9
500-999	18,153	22,762	25.6	25.4
1,000+	23,290	25,775	32.8	28.8
Total	70,958	89,642	100.0	100.0
<b>Barley</b>				
1-99	4,758	6,732	8.2	7.5
100-259	10,010	14,347	17.1	16.0
260-499	9,693	15,643	16.6	17.4
500-999	11,098	19,247	19.0	21.4
1,000+	22,871	33,979	39.1	37.8
Total	58,430	89,948	100.0	100.0
<b>Oats</b>				
1-99	18,494	29,168	13.1	14.1
100-259	43,933	68,947	31.2	33.4
260-499	34,207	51,012	24.3	24.7
500-999	23,895	32,991	17.0	16.0
1,000+	20,226	24,074	14.4	11.8
Total	140,755	206,192	100.0	100.0

Source: 1992 and 1987 Census of Agriculture.



**Table 6—Number of farms in the United States by sales class, 1992 and 1987**

Sales class	Farms		Percentage of total	
	1992	1987	1992	1987
	-----Percent-----		-----Percent-----	
<b>Corn</b>				
Less than \$10,000	81,622	139,801	16.2	22.3
\$10,000-\$39,999	129,397	179,328	25.7	28.5
\$40,000-\$99,999	118,365	153,745	23.5	24.5
\$100,000-\$249,999	117,354	115,264	23.3	18.4
\$250,000-\$499,999	40,516	29,282	8.0	4.7
\$500,000 or more	16,681	7,579	3.3	1.6
Total	503,935	627,602	100.0	100.0
<b>Sorghum</b>				
Less than \$10,000	7,963	14,852	11.2	16.6
\$10,000-\$39,999	18,926	28,359	26.7	31.6
\$40,000-\$99,999	18,334	23,583	25.8	26.3
\$100,000-\$249,999	16,624	16,264	23.4	18.1
\$250,000-\$499,999	6,159	4,717	8.7	5.3
\$500,000 or more	2,952	1,867	4.2	2.1
Total	70,958	89,642	100.0	100.0
<b>Barley</b>				
Less than \$10,000	5,080	9,915	8.7	11.0
\$10,000-\$39,999	11,849	24,416	20.3	27.1
\$40,000-\$99,999	15,716	28,199	26.9	31.4
\$100,000-\$249,999	16,932	19,817	29.0	22.0
\$250,000-\$499,999	5,964	5,276	10.2	5.9
\$500,000 or more	2,889	2,325	4.9	2.6
Total	58,430	89,948	100.0	100.0
<b>Oats</b>				
Less than \$10,000	22,745	38,276	16.1	18.6
\$10,000-\$39,999	35,050	58,603	24.9	28.4
\$40,000-\$99,999	37,690	59,299	26.8	28.8
\$100,000-\$249,999	33,846	39,857	24.0	19.3
\$250,000-\$499,999	8,651	7,947	6.2	3.8
\$500,000 or more	2,773	2,210	2.0	1.1
Total	140,755	206,192	100.0	100.0

Source: 1992 and 1987 Census of Agriculture.

age planted to feed grains. However, producers probably do not make decisions on whether to participate or not simply based on 1-year expected returns, because of a desire to maintain their base. Also, bankers and financial lenders often make major contributions to the farmer's decision of whether to participate in the ARP or not. Conservation compliance requirements also play a role.

Feed grain producers have maintained a high rate of program participation in the early 1990's, suggesting that net returns from program participation were higher than those from nonparticipation for most producers. Since 1991, the first year that 1990 farm legislation was implemented, about 80 percent of corn, sorghum, and barley effective base acres were enrolled in the programs. Program participation in the early 1990's was slightly lower than in the late

1980's for corn, but slightly higher for sorghum and barley. As in the past, program participation for oats tends to be lower than for other feed grains. Only 41 percent of oats effective base acreage was enrolled in the oat program in the early 1990's. However, this rate of participation is higher than the late 1980's level, likely because of the ability to flex acres to other crops.

### ***Trends in Domestic Use and Stocks***

In the 1980's and the early 1990's, weather and government programs caused larger fluctuations in feed grain production and stocks than during earlier times. The combination of the PIK (payment in kind) program and summer drought reduced U.S. corn production in 1983 to 4.2 billion bushels, the smallest corn harvest since 1970. An early summer drought and heat wave

greatly reduced the corn harvest to 4.9 billion bushels in 1988. The combined floods in the Midwest and drought in the Southeast in 1993 once again reduced the corn harvest to 6.3 billion bushels, down from the 9.5-billion-bushel bumper crop in 1992. Ending stocks of corn reached 850 million bushels, the lowest since the mid-1970's (table 8). However, the estimated record crop harvest of 10.1 billion bushels in 1994 is forecast to replenish ending stocks to 1.7 billion bushels (fig. 5).

Total disappearance of feed grains has trended upward during the last two decades. It is forecast to reach a record 267 million metric tons in the 1994/95 marketing year: 211 million metric tons for domestic use and 56 million metric tons for exports. Most of the expansion came from domestic use. Feed and residual use averaged around 140 million metric tons over the last decade, but dropped to below 120 million metric tons in 1988/89 due to drought. U.S. feed grain exports tended to fluctuate in response to changing import demands and changes by competing exporters. Over the last two decades, U.S. feed grain exports averaged 53 million metric tons, but fluctuated in a range from 34 million to 71 million.

### **Crop Acreage Base**

The crop acreage base is the moving average of acres planted or considered planted (primarily acres put into conserving use under the acreage reduction program and acres planted to soybeans, minor oilseeds, and other permissible crops on the flex acreage) to the program crop for the previous 5 years. The 1990 farm legislation allows more planting flexibility while protecting the crop acreage base. For example, corn producers can plant the crop of their own choice (except fruits, vegetables, dry edible beans, or potatoes) on up to 25 percent of their crop base acreage—a 15-percent "normal flex acreage" and an additional 10-percent "optional flex acreage"—without losing their corn base acreage. No deficiency payments will be made on the 15-percent normal flex acreage even if a producer grows the program crop. During 1991-94, about 3.3 million acres of corn flex acres were planted to soybeans, minor oilseeds, and other nonprogram crops per year. For program participation purposes, corn and sorghum permitted plantings are combined into one permitted acreage on which producers have the flexibility to plant any combination of corn and sorghum. However, deficiency payments and planted and considered planted acreage credit will accrue as if corn were planted on corn base and sorghum were planted on sorghum base. Since 1986, the national corn effective base has remained stable at 82-83 million acres (table 7).

**Livestock and Poultry Feed.** Livestock and poultry feeding accounted for about 75 percent of the domestic use of feed grains in recent years. "Feed and residual" use, which is a residual obtained by subtracting food, seed, and industrial use (FSI), exports, and ending stocks from total feed grain supply (including beginning stocks, production, and imports), is used to approximate feed use of feed grains. No direct feed use statistics are available. Corn, being the primary energy feed ingredient, accounted for 81 percent of feed and residual use of all grains in 1993/94 (table 9). Over the last decade, feed use of feed grains ranged from a low of 119 million metric tons in 1988/89 to a record 154 million metric tons in 1992/93 when cattle on feed stood at 10.9 million head in 13 major States and grain-consuming animal units (GCAU's) totaled 82.9 million.<sup>3</sup> Feed and residual use of feed grains, being a derived demand, is positively related to cattle on feed, or more generally to the number of animal units (includes hogs and poultry as well). For example, feed use of corn expanded in 1990/91 as cattle on feed in the 13 major States rose from 9.9 million head to 10.8 million and GCAU's increased from 77.7 million head to 80.3 million (tables 8 and 9).

<sup>3</sup> Grain-consuming animal units, as reported by the U.S. Department of Agriculture, refer to livestock and poultry numbers weighted by all concentrates consumed via an indexing procedure. This indexing procedure converts livestock and poultry numbers into a common unit, called animal units, based on the feed consumed by one dairy cow in the 1969-71 feeding years.

**Table 7—Feed grain base acreage, planted acreage, yield, and production, 1986-94**

Item	Unit	1986	1987	1988	1989	1990	1991	1992	1993	1994 <sup>1</sup>
<b>Corn</b>										
Base acres	Mil. ac.	81.7	81.5	82.9	82.7	82.6	82.7	82.2	81.8	81.5
Planted acres	Do.	76.6	66.2	67.7	72.3	74.2	76.0	79.3	73.2	79.2
Program yield	Bu./ac.	105.0	104.0	104.3	104.6	104.6	104.6	105.4	105.2	105.5
Yield	Do.	119.4	119.8	84.6	116.3	118.5	108.6	131.5	100.7	138.6
Production	Mil. bu.	8,226	7,131	4,929	7,532	7,934	7,475	9,477	6,336	10,103
<b>Sorghum</b>										
Base acres	Mil. ac.	19.0	17.4	16.8	16.2	15.4	13.5	13.6	13.5	13.5
Planted acres	Do.	15.3	11.8	10.3	12.6	10.5	11.1	13.2	9.9	9.8
Program yield	Bu./ac.	60.0	59.0	57.9	58.3	57.7	58.0	59.1	59.0	59.2
Yield	Do.	67.7	69.4	63.8	55.4	63.1	59.3	72.6	59.9	73.0
Production	Mil. bu.	939	731	577	615	573	585	875	534	655
<b>Barley</b>										
Base acres	Mil.ac.	12.4	12.5	12.5	12.3	11.9	11.5	11.1	10.8	10.7
Planted acres	Do.	13.0	10.9	9.8	9.1	8.2	8.9	7.8	7.8	7.2
Program yield	Bu./ac.	49.0	48.0	47.3	45.6	45.2	46.2	46.4	47.0	47.1
Yield	Do.	50.8	52.4	38.0	48.6	56.1	55.2	62.5	58.9	56.2
Production	Mil. bu.	609	522	290	404	422	464	455	398	375
<b>Oats</b>										
Base acres	Mil. ac.	9.2	8.4	7.9	7.6	7.5	7.3	7.2	7.1	6.8
Planted acres	Do.	14.7	17.9	13.9	12.1	10.4	8.7	7.9	7.9	6.6
Program yield	Bu./ac.	50.0	50.0	47.0	45.0	43.6	48.7	48.6	48.6	49.6
Yield	Do.	56.3	54.3	39.3	54.3	60.1	50.6	65.4	54.4	57.2
Production	Mil. bu.	385	374	218	374	358	244	294	207	230

<sup>1</sup>Estimate as of Jan. 12, 1995.

**Table 8—U.S. feed grain supply and disappearance, 1986/87-1994/95**

Marketing year	Supply			Disappearance				Ending stocks		
	Beginning stocks	Production	Total	Food, seed, and industrial	Feed and residual	Exports	Total	Government owned	Privately owned	Total
<i>Million metric tons</i>										
<b>Feed grains</b>										
1986/87	126.4	251.6	379.4	36.4	144.3	45.9	266.6	48.7	103.4	152.1
1987/88	152.1	216.5	370.6	37.2	146.7	52.1	236.0	34.1	99.5	133.6
1988/89	133.6	149.3	285.4	38.7	118.5	61.1	218.3	18.6	47.3	65.9
1989/90	65.9	221.2	289.4	40.3	132.7	69.7	242.7	10.5	35.0	45.5
1990/91	45.5	230.5	278.6	40.6	137.5	51.5	229.6	11.3	36.4	47.7
1991/92	47.7	218.4	270.3	42.7	141.8	49.7	234.2	3.2	30.7	34.0
1992/93	34.0	277.1	312.3	44.1	154.4	51.1	249.7	1.6	61.5	63.1
1993/94	63.1	186.2	252.9	46.2	139.0	40.3	225.5	1.3	26.1	27.4
1994/95 <sup>1</sup>	27.4	284.8	315.0	49.0	161.5	56.4	266.9	1.2	46.9	48.1
<i>Million bushels</i>										
<b>Corn</b>										
1986/87	4,040	8,226	12,267	1,224	4,669	1,493	7,385	1,443	3,439	4,882
1987/88	4,882	7,131	12,016	1,243	4,798	1,716	7,757	835	3,424	4,259
1988/89	4,259	4,929	9,191	1,293	3,941	2,026	7,260	363	1,568	1,930
1989/90	1,930	7,532	9,464	1,356	4,396	2,368	8,120	233	1,111	1,344
1990/91	1,345	7,934	9,282	1,373	4,663	1,725	7,761	371	1,150	1,521
1991/92	1,521	7,475	9,016	1,454	4,877	1,584	7,915	113	988	1,100
1992/93	1,100	9,477	10,584	1,511	5,296	1,663	8,471	56	2,057	2,113
1993/94	2,113	6,336	8,470	1,588	4,704	1,328	7,620	45	805	850
1994/95 <sup>1</sup>	850	10,103	10,958	1,700	5,650	1,950	9,300	43	1,615	1,658
<b>Sorghum</b>										
1986/87	551	939	1,490	12	536	198	747	409	334	743
1987/88	743	731	1,474	25	555	232	812	464	199	663
1988/89	663	577	1,239	22	466	312	800	341	99	440
1989/90	440	615	1,055	15	517	303	835	163	57	220
1990/91	220	573	793	9	410	232	651	65	78	143
1991/92	143	585	727	9	374	292	674	8	45	53
1992/93	53	875	928	8	469	277	753	4	171	175
1993/94	175	534	709	8	453	202	662	1	47	48
1994/95 <sup>1</sup>	48	655	703	8	400	220	628	1	74	75

Continued—

Table 8—U.S. feed grain supply and disappearance, 1986/87-1994/95 (cont.)

Marketing year	Supply			Disappearance				Ending stocks		
	Beginning stocks	Production	Total	Food, seed, and industrial	Feed and residual	Exports	Total	Government owned	Privately owned	Total
<i>Million bushels</i>										
<b>Barley</b>										
1986/87	327	609	942	175	298	134	606	76	261	336
1987/88	336	521	869	174	253	121	548	50	271	321
1988/89	321	290	622	175	171	79	425	30	166	196
1989/90	196	404	614	176	193	84	453	19	142	161
1990/91	161	422	596	176	205	81	461	8	127	135
1991/92	135	464	624	176	225	95	496	7	122	129
1992/93	129	455	595	171	192	80	444	5	146	151
1993/94	151	398	621	175	241	66	482	5	134	139
1994/95 <sup>1</sup>	139	375	574	175	225	60	460	5	109	114
<b>Oats</b>										
1986/87	184	385	601	83	385	1	468	4	129	133
1987/88	133	374	552	81	358	1	440	4	108	112
1988/89	112	217	392	100	194	1	294	2	96	98
1989/90	98	374	538	115	266	1	381	1	156	157
1990/91	157	358	578	120	286	1	407	0.4	171	171
1991/92	171	244	490	125	235	2	362	0.2	128	128
1992/93	128	294	477	125	233	6	364	0.1	113	113
1993/94	113	207	427	125	193	3	321	0	106	106
1994/95 <sup>1</sup>	106	230	435	125	200	1	326	0	109	109

<sup>1</sup>Forecast as of Jan. 12, 1995.

**Table 9—Feed use and animal numbers, marketing years 1985/86-1993/94**

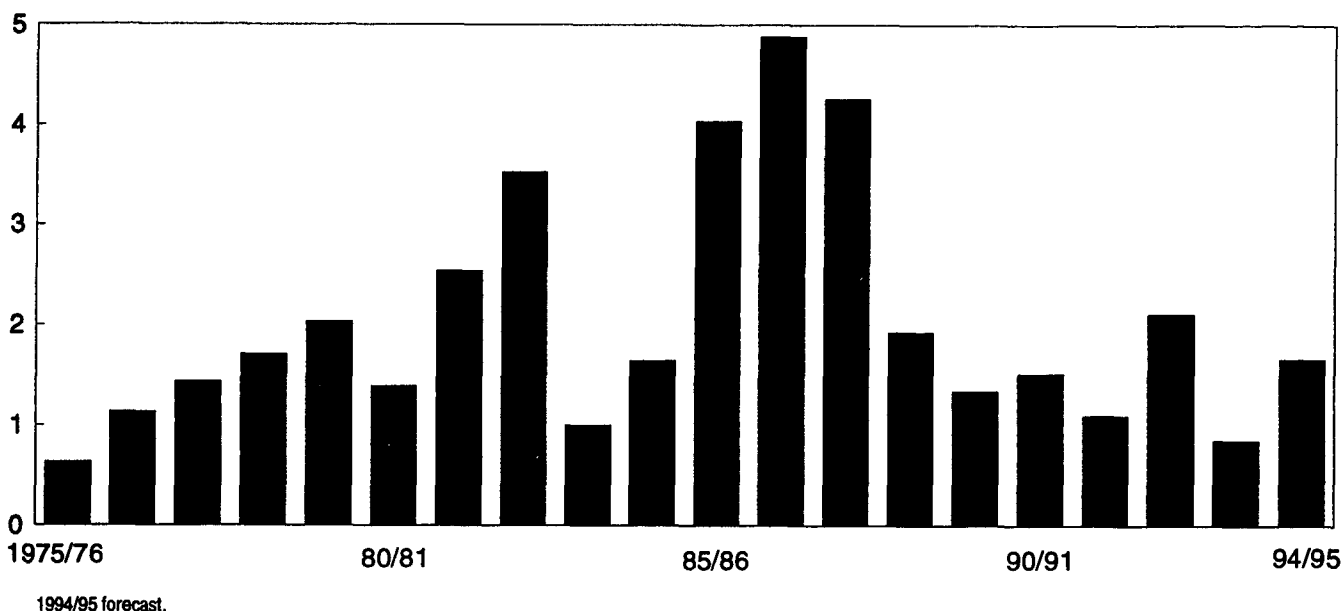
Item	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94
<i>Million metric tons</i>									
<b>Feed:</b>									
Corn	104.5	118.6	121.9	100.1	111.5	118.4	123.9	134.7	119.7
Sorghum	16.9	13.6	14.1	11.8	13.1	10.4	9.5	12.1	12.4
Feed grains <sup>1</sup>	135.1	144.3	146.7	118.5	132.7	137.5	141.7	154.4	140.1
Wheat	7.7	10.9	7.9	4.1	3.8	13.5	6.8	5.1	7.6
All grains	142.8	155.2	154.6	122.6	136.5	151.0	148.5	159.5	147.7
Meals <sup>2</sup>	19.8	20.7	21.9	20.3	22.5	23.3	23.9	25.0	25.8
All grains and meals	162.6	175.9	176.5	142.9	159.0	174.3	172.4	184.5	173.5
<i>Million units</i>									
<b>Animals:</b>									
GCAU <sup>3</sup>	74.5	74.4	76.8	77.0	77.7	80.3	81.1	82.9	84.1
<i>Million head</i>									
Cattle <sup>4</sup>	10.0	9.6	10.1	9.7	9.9	10.8	10.1	10.9	11.1
<i>Dollars per bushel</i>									
<b>Prices:</b>									
Corn	2.23	1.50	1.94	2.54	2.36	2.28	2.37	2.07	2.50
Sorghum	1.93	1.37	1.70	2.27	2.10	2.12	2.25	1.89	2.31
Wheat	3.08	2.42	2.59	3.72	3.72	2.61	3.00	3.24	3.26
<i>Metric tons per GCAU</i>									
Feed rate <sup>5</sup>	2.18	2.36	2.30	1.86	2.05	2.17	2.13	2.23	2.06

<sup>1</sup>Includes corn, sorghum, barley and oats.<sup>2</sup>Includes the following meals: soybean, cottonseed, peanut, linseed, sunflowerseed, rapeseed, and fish.<sup>3</sup>Grain-consuming animal units (GCAU's) (see footnote 3 in the text).<sup>4</sup>13 major States, Jan. 1 of the second year indicated.<sup>5</sup>Total grains and meals per grain-consuming animal unit.

Figure 5

## Corn Ending Stocks

Billion bushels



In addition to the change in number of animals fed, the variation in feed use reflects adjustments made by livestock and poultry producers in response to relative prices and availability of corn and competing feed grains or feed ingredients (see box, "Substitution Among Feedstuffs"). Higher corn prices, because of drought and increased exports, lowered corn feed use from 4.8 billion bushels in 1987/88 to 3.9 billion bushels the following year. The record corn feed and residual use of 5.3 billion bushels in 1992/93 reflected not only the steady level of GCAU's since the late 1980's but also the decline in corn prices from \$2.37 per bushel in 1991/92 to \$2.07 in 1992/93 (fig. 6). Factors such as variations in crop quality and the volume of feed required to achieve a particular ingredient content can also affect feed value and thus affect the amount of grain needed to maintain a particular level of animal weight gain.

Prices of competing feed grains and feed wheat also are important determinants of feed use of feed grains. For example, the corn-to-sorghum feed use ratio increased from 11 to 1 in 1990/91 to 13 to 1 in 1991/92, partly because corn became cheaper relative to sorghum as the corn-to-sorghum price ratio declined from 1.08 to 1 in 1990/91 to 1.05 to 1 in 1991/92. As a rule, livestock feeders and feed manufacturers tend to increase (decrease) feed use of a feed grain when the price of that feed grain relative to corn is lower (higher) than its feed value (in corn equivalent). Wheat feeding, which occurs mostly in late summer

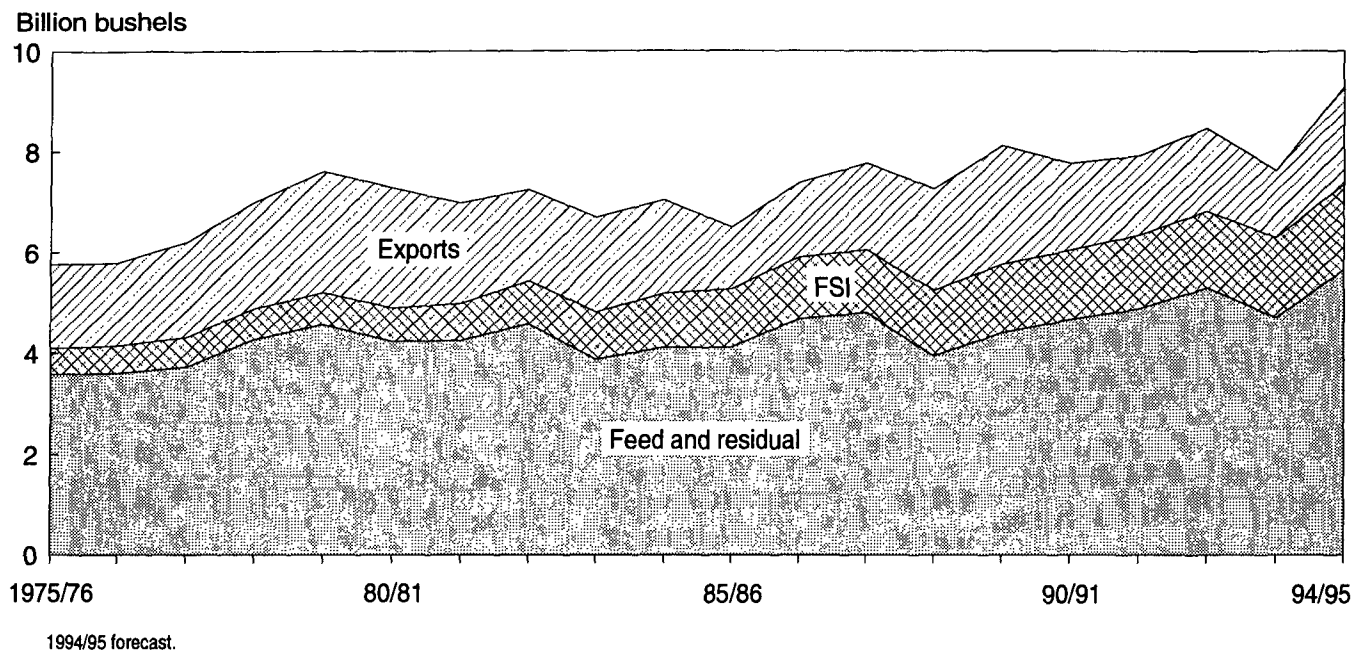
### Substitution Among Feedstuffs

Numerous feedstuffs are used to satisfy the nutritional requirements of livestock and poultry. Roughage feeds generally account for about 60 percent of total feeds consumed, while concentrates make up the remainder. Feed concentrates include feed grains, wheat, rye, oilseed meals, animal protein feeds, grain byproducts, mineral supplements, and micro-ingredients.

Competition among feed ingredients depends on relative prices and their relative feed values. Average feed values on a bushel-for-bushel basis differ from the pound-for-pound basis because bushel weights generally are different, although corn and sorghum each weigh 56 pounds. Feed values (based on one criterion, total digestible nutrients) for major grains averaged across all livestock classes are shown below in terms of a percentage of corn's value (that is, in corn equivalent):

	Pound for pound	Bushel for bushel
Corn	100	100
Sorghum	95	95
Barley	90	77
Oats	90	51
Wheat	105	113

Figure 6  
**Corn Disappearance**



before corn is harvested, greatly expanded from 3.8 million metric tons in 1989/90 to 13.5 million metric tons in 1990/91 because wheat became much cheaper relative to its feed value than corn in 1990/91. The ratio of wheat prices to corn prices declined from 1.58 to 1 in 1989/90 to 1.14 to 1 in 1990/91, which is comparable with the feed value of wheat.

Some feed grains do not enter the commercial market but are fed to livestock and poultry also raised on the farms. A smaller percentage of U.S. corn production is fed to onfarm livestock and poultry than is sold to commercial markets. Country elevators are the primary assemblers of corn sold from farms, although some corn moves directly from farms to subterminal and terminal elevators.

The feed manufacturing industry is the most important user of corn in terms of sales volume. In 1984 (the latest year data are available), 6,411 feed manufacturers with potential annual capacity to produce 1,000 tons or more of feed produced 109.5 million tons of formula feed. The industry processes and mixes feed ingredients to specifications. Ingredients include corn and other feed grains, oilseed meals, grain byproducts, animal protein, minerals, and micro-ingredients.

**Food, Seed, and Industrial Uses.** Food, seed, and industrial (FSI) uses of feed grains, although accounting for only 20-25 percent of domestic use, have been

steadily increasing over the years. These uses of corn exceeded the 1-billion-bushel mark in 1984/85 and reached 1.6 billion bushels in 1993/94, exceeding corn exports for the first time (fig. 7). In general, demand for feed grains for FSI uses is related to the state of the economy and population growth. Legislation and government policy play a critical role in the use of corn for ethanol, however, and indirectly in the use of corn sweeteners.

The rates of increase in FSI use vary depending upon the use. Typically, a new use is found and use increases rapidly until the market "matures." It then tends to grow with population. Seed uses vary with the amount of the crop grown—demand for seed oats will increase if farmers need cover-crops on ARP land enrolled in the program. Seed uses are likely to remain stable in the future assuming the number of acres available for plantings does not expand significantly.

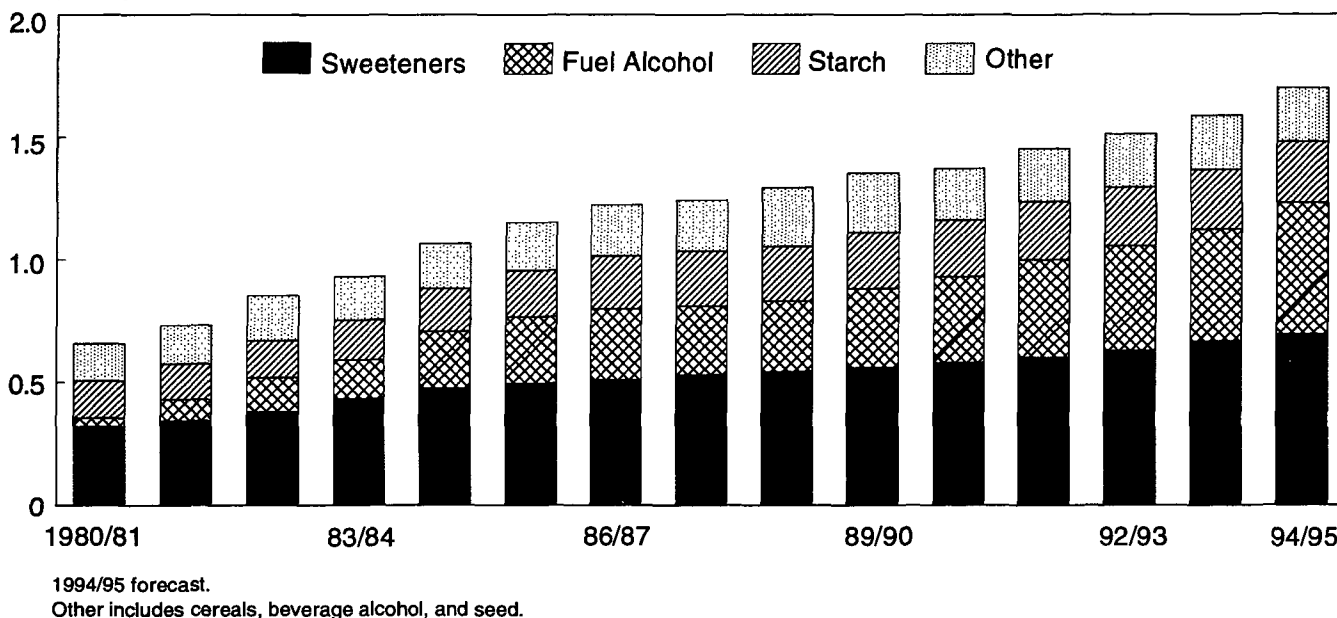
Food uses of grains will continue to increase as the population grows in the future. Food uses of corn are expected to remain in the mature market phase. Demand for corn sweeteners is stimulated indirectly by the sugar program. Import fees, duties, and restrictive import quotas used to administer the current sugar program kept the domestic refined sugar price at an artificially high level, making high-fructose corn syrup (HFCS) and other sweeteners more attractive to the soft drink industry and other users. Use of corn sweet-



Figure 7

**Corn: Food, Seed, and Industrial Use**

Billion bushels



eners will likely continue to grow but future growth is unlikely to match the very rapid growth of the early 1980's (fig. 8). Also, future adjustments in sugar policies could lead to some shifts in corn sweetener use.

Demands for corn-based cereals, snack foods, and other corn-based baked goods are expected to grow at the same rate as the population—1 to 2 percent per year. There is no reason to believe corn grits, oatmeal, cooked pearly barley, or cooked sorghum will develop into staples in future U.S. meals; food shifts generally are made slowly so future meals are likely to be much like present meals. Food uses of oats increased rapidly when oat bran became popular and have remained at relatively high levels, but future rapid growth is not expected at the current time. Food use of barley has been relatively constant with pearly barley used in soups and barley malt or extract used as a flavoring in many products but at a relatively low level.

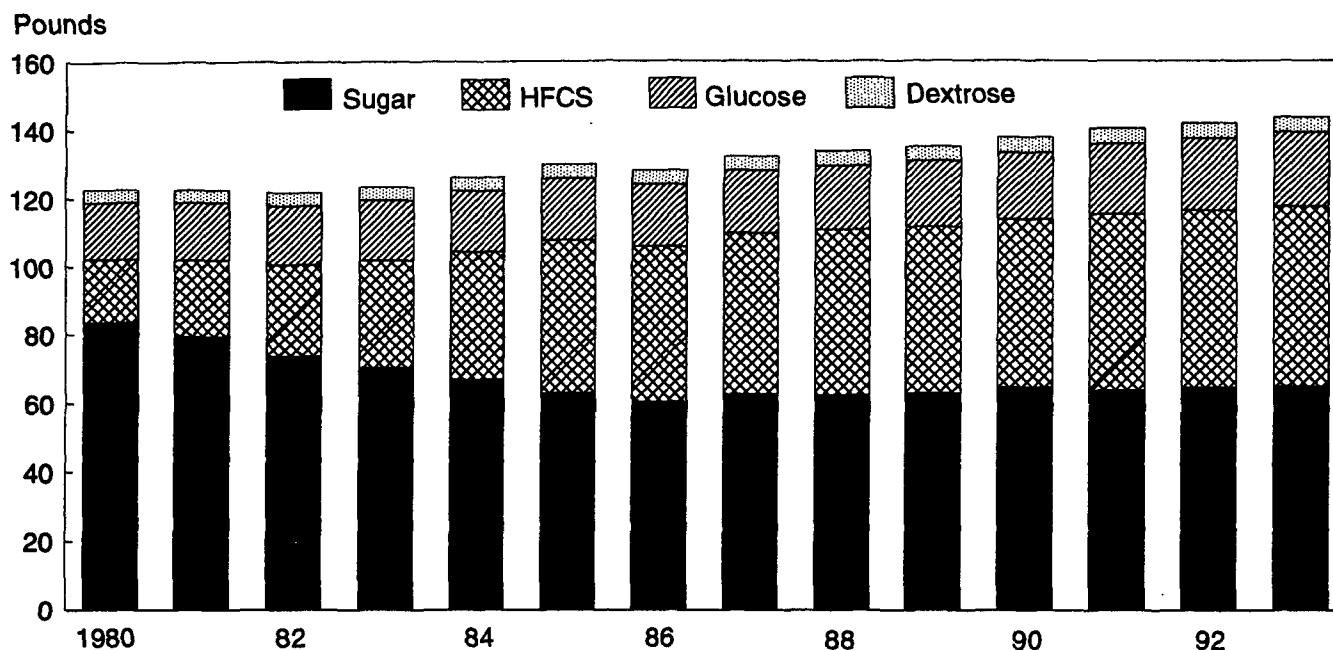
The products made from corn starch have been expanding over the years and chemists are continuing to find new uses for corn starch. Many of these are not now economically viable, but that will likely change. Currently, the most important uses are by the paper industry as a coating on paper, and also by the construction material industry as a component in the manufacture of wall board. These are mature uses and the rate of growth is generally comparable with the growth in population and expansion of the econ-

omy. In addition, food use in many prepared foods, primarily as a thickening agent, is estimated to account for 15 percent of total corn starch use.

**Alcohol Fuel.** In contrast to food and other industrial uses of feed grains, which expand at the rate of population growth or vary with income growth, fuel alcohol use of corn depends more on a mix of government incentives, legislation, technology, and prices of substitute products. Use of corn for fuel production has been growing rapidly in recent years. Corn used for fuel alcohol is expected to reach 535 million bushels in 1994/95, 6 percent of total corn use, up from less than 1 percent 14 years ago.

The demand for ethanol is enhanced by Federal and State incentives begun during the energy crisis of the early 1970's. In 1994, the U.S. ethanol industry (concentrated in the Corn Belt area) produced about 1.3 billion gallons of ethanol. Most fuel alcohol is made from the starch component of corn kernels. Wet corn millers have been making alcohol because the alcohol provided a use for the "extra" starch in the winter when demand for sweeteners is lower. The winter carbon monoxide reduction program helped even out demand for the corn starch during the year. An income tax credit of 54 cents per gallon of alcohol is allowed to blenders of alcohol and gasoline for use as a fuel, assuming a blend of 10-percent alcohol and 90-percent motor fuel. Thus, in addition to corn and petroleum

Figure 8  
**U.S. Per Capita Sweetener Consumption**



prices, government tax incentives play a key role in determining the competitive position of ethanol.

The Clean Air Act Amendments (CAAA) of 1990 have led to greater use of corn in fuel alcohol production. The addition of alcohol helps to meet clean air standards by reducing carbon monoxide emissions, especially in the winter. The CAAA required 39 cities that fail to meet carbon monoxide air quality standards to sell only oxygenated gasoline during winter months no later than November 1, 1992. Another 9 cities, which have the most serious ozone pollution problems, are required to sell reformulated gasoline year round, beginning January 1, 1995. The Environmental Protection Agency (EPA) has approved methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), fuel ethanol, and others as oxygenates for blending in these oxygenated and reformulated fuels. In addition, in June 1994, EPA announced a rule that renewable resources must account for 15 percent of the oxygenates in reformulated fuels by 1995 and 30 percent thereafter. Implementation of this rule is presently in abeyance because of litigation pending in the courts. The oil industry has challenged this renewable oxygenate requirement, and the courts are currently evaluating the requirement to determine if mandated use of renewable oxygenates is legal.

In the long run, the prospects of demand growth of alcohol fuel will also be shaped by technological

developments in the use of corn, competition with other oxygenated substitute products and other biomass materials that can be converted into ethanol, and Federal and State tax incentives for alcohol fuel.

**Beverages and Other Alcohols.** Beverage uses of the four feed grains have tended to be more variable than food uses because alcohol consumption varies with the health of the economy. Also, various campaigns to reduce consumption of alcohol may have slowed increases in beverage use of grains, while aging of the population may have also contributed to lower per capita use of beer. Barley is the leading ingredient used by brewers to produce beer, followed by corn and rice. Light beers may use corn sweeteners to cut the calories from the grain, holding down growth in brewers' grain use. Currently, small "traditional" brewers have been increasing beverage production, using barley as the base and, in some cases, wheat. If these small brewers continue to multiply, grain use in beer production could increase somewhat in the future.

Distilled alcohol is made from corn, barley, wheat, rye, and sorghum, with corn being the most commonly used grain. Some of the alcohol is distilled to make grain neutral spirits—nearly all alcohol—which are then used to make gin and vodka and, to a lesser extent, blended whiskey. Some of the grain neutral spirits are made from corn starch or wheat starch. Alcohol plants that are licensed as beverage plants make alcohol for human

consumption, but sometimes the alcohol is sent to denaturing facilities and used for manufacture of fuel alcohol.

## Financial Characteristics

### Trends In Prices and Farm Returns

Over the last decade, feed grain prices received by farmers mostly exceeded the national loan rates. Feed grain farm prices were temporarily below the national loan rates during the 1985-87 crop years because of the issuance and exchange of generic certificates which could be used to repay outstanding CCC (the Commodity Credit Corporation) loans and to acquire stocks owned by the CCC. These certificates, therefore, freed stocks that otherwise would be unavailable to the market when corn ending stocks exceeded 4.0 billion bushels and the stocks-to-use ratio averaged about 60 percent.

Feed grain prices fluctuate in response to changing market conditions. Prices of sorghum, barley, and oats, due to their substitutability for corn as an energy feed ingredient, tend to follow the price movement of corn (fig. 9).

Corn prices tend to be inversely related to ending stocks. In 1987, corn ending stocks grew to a record 4.9 billion bushels, which, together with the issuance

and exchange of generic certificates, temporarily lowered farm prices below the loan rates.

Severe drought in 1988 resulted in a 31-percent jump in corn prices to \$2.54 per bushel. Prices slipped back to \$2.36 per bushel in 1989/90 and remained relatively stable until 1992/93 when record corn production of 9.5 billion bushels led to a downturn. Between 1988 and 1991, corn ending stocks were below 2 billion bushels. This, in combination with declining loan rates, kept corn prices above the national loan rates in these years (fig. 10).

Heavy rainfall and floods in 1993 caused late planting and abandoned acreage, which greatly reduced ending stocks from 2.1 billion bushels in 1992/93 to 850 million bushels (the lowest since 1975/76) and resulted in an upturn of corn prices. The record 1994 corn crop (10.1 billion bushels), however, is expected to replenish the ending stocks to about 1.7 billion bushels in 1994/95 and to bring corn prices received by farmers to \$2.00-\$2.40 per bushel.

There are many ways to indicate the financial health of feed grain producers. One measure, farmers' returns above cash expenses, shows their changing average cash-flow position (table 10). These net returns are determined by subtracting total cash expenses from gross receipts. The gross receipts include corn sales receipts and direct Government payments. Returns

Figure 9  
**Farm Prices of Feed Grains**

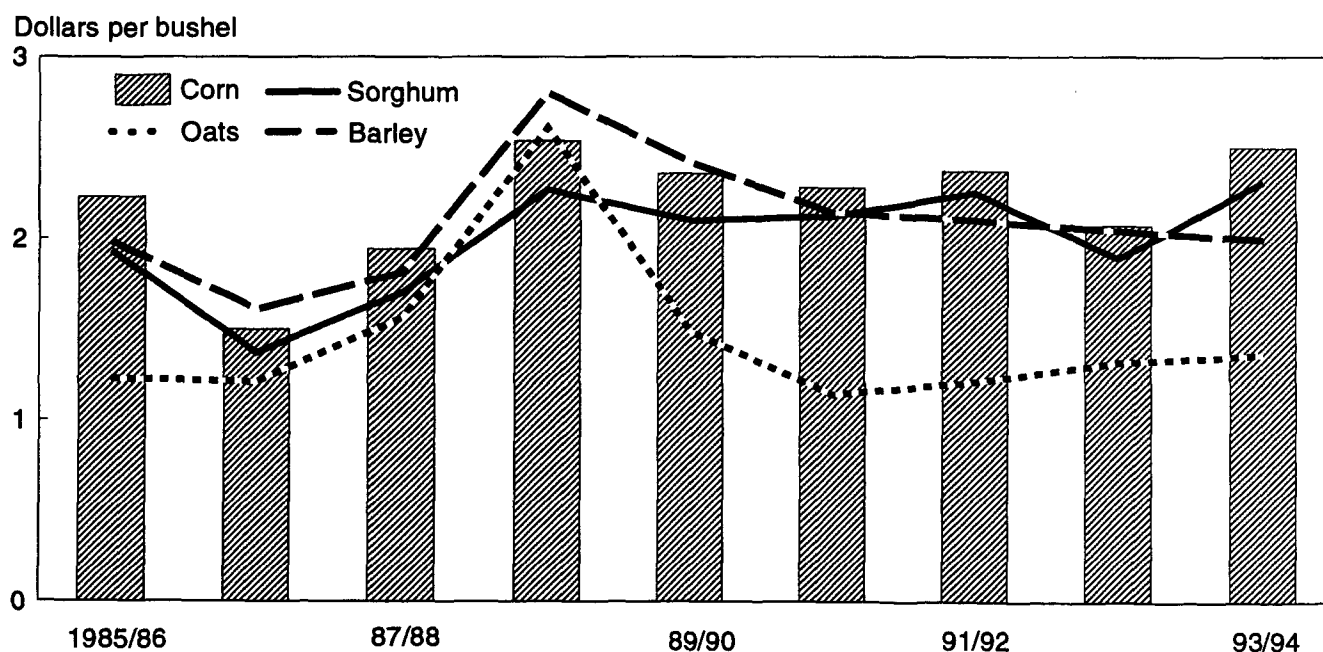
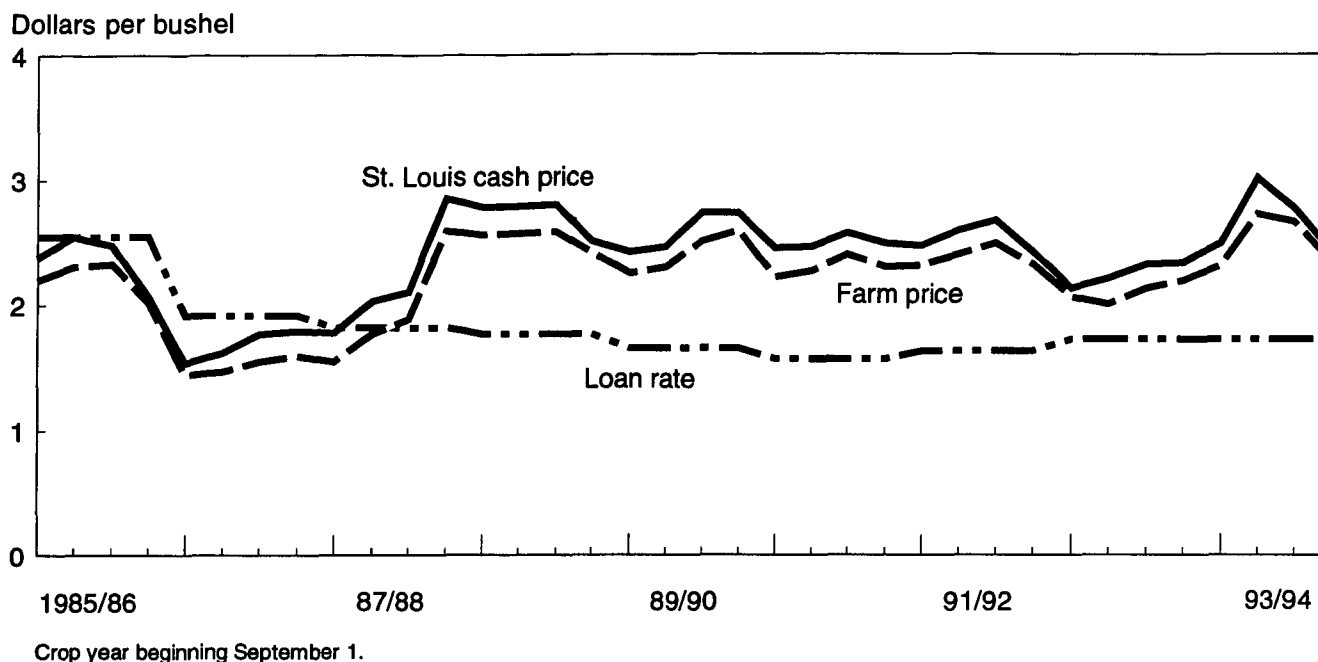


Figure 10  
**Corn Prices and Loan Rates by Quarter, 1985/86 - 1993/94**



above cash expenses are available for paying expenses associated with land, capital replacement, family debt, and living expenses.

The cash-flow position of feed grain producers depends on market prices, crop yields and the level of Government payments on the revenue side, and interest payments and input prices on the expense side. The declines in interest payments and increases in Government payments during the late 1980's strengthened feed grain producers' cash-flow positions. During 1987-89, returns over cash expenses for corn producers averaged \$1.20 (in 1987 dollars) per bushel, compared with \$0.71 in 1985.

In recent years, however, cash expenses (primarily seed, chemicals, taxes, and insurance) rose again and thereby contributed to the weakening of the cash-flow positions of feed grain producers. Returns over cash expenses for corn producers during 1991-93 were only two-thirds of those during 1988-90, the years before 1990 farm legislation was enacted by Congress. The floods of 1993 greatly reduced corn yields to an average of 101 bushels per acre and thus lowered the value of total output. In the meantime, Government payments declined from \$4.0 billion in 1992/93 to \$2.7 billion in 1993/94. The lower value of 1993 corn crops, together with the lower Government payments, caused the cash-flow position of corn producers to reach its lowest point over the last decade. The cash-

flow position of corn producers is expected to strengthen in 1994/95 due to higher value of output, brighter demand, and larger deficiency payments.

Cash-flow positions for other feed grains were relatively brighter in recent years, compared with those before 1990 farm legislation was implemented. Nonetheless, returns over cash expenses for corn were still the highest of the feed grains on a per acre basis, averaging about \$76 (in 1987 dollars) per acre over the last 3 years. Sorghum and barley producers had lower returns, and oats producers continued to have the lowest returns over cash expenses, averaging \$16 per acre. Overall returns over cash expenses are expected to improve considerably in 1994/95 resulting from record corn yields, strong demand, and higher deficiency payments.

The significance of Government payments as a component of gross income has varied over the last few decades. Corn program payments fluctuated from less than \$200 million per year in the mid-1970's to \$8 billion in 1987. Government payments, however, have declined since 1987 as corn prices strengthened. Over the last decade, the proportion of Government payments in most feed grain producers' gross income ranged from 10 percent to 40 percent, although that proportion was lower for oats producers, ranging from 1 percent to 25 percent. Government payments accounted for an average of 14 percent of corn producers' gross income since the 1990 farm legislation was en-